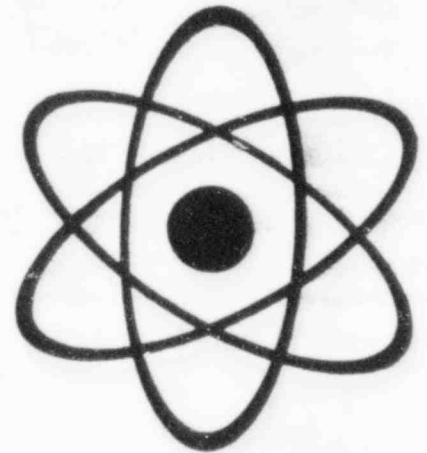
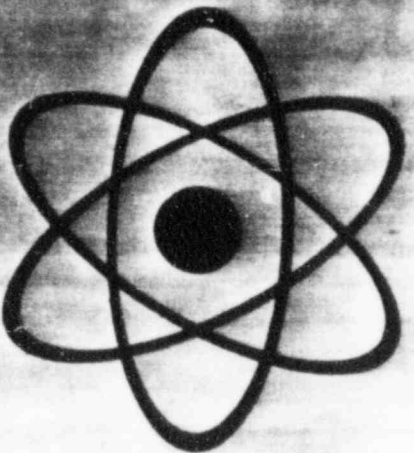


a special management report

marble hill nuclear project

january 1982



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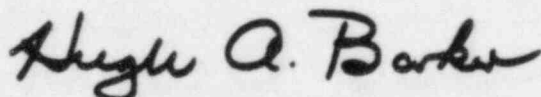
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Broad media coverage recently has spotlighted construction problems at several nuclear power projects around the country. On more than one occasion in the past two months, representatives of the Nuclear Regulatory Commission have made public statements about construction problems at several nuclear sites. These statements have unintentionally strengthened the impression that all of these projects—including Marble Hill—are at similar stages of concern and correction.

This is not so. It is not a fair representation of Marble Hill. Our construction problems—and we did not minimize them—occurred in 1979 and have been followed by two full years of intense and thorough reorganization and corrective programming. This progress, in fact, has been officially noted by the Nuclear Regulatory Commission, and we believe those early construction problems have been left far behind—resolved responsibly and in a manner that will assure no recurrence. This turnabout attests to Public Service Indiana's commitment to assuring quality in design, construction and operation of Marble Hill.

This special report prepared for our corporate directors puts the problems and the corrective actions in perspective and documents the real progress made in attaining our goal of constructing and operating a safe and reliable nuclear facility.



Hugh A. Barker
Chairman
Public Service Indiana

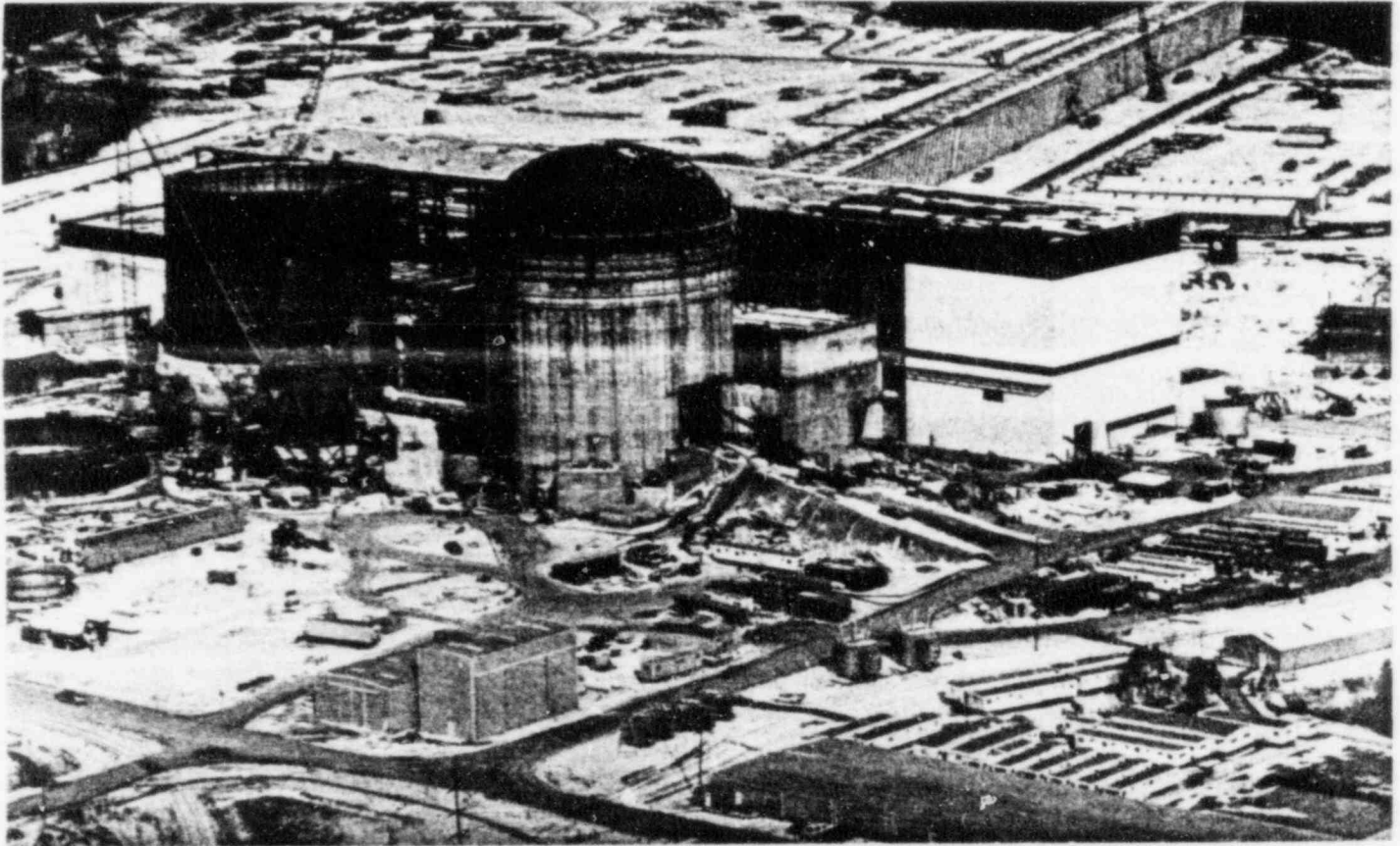
On August 7, 1979, Public Service Indiana suspended all safety-related work on its Marble Hill project. Eight days later the Nuclear Regulatory Commission issued a confirming order and specified nine steps to be taken before safety-related work could be resumed. (Safety-related work includes the reactor containment buildings, the auxiliary building and those systems which are required to bring the plant to a safe shut-down in the event of an emergency.)

what led to these actions?

The initial focus of attention was on the inadequate repair of "honeycombs" which occur normally in concrete work, but more frequently when concrete is placed around greater-than-normal amounts of steel reinforcing material, such as in a nuclear plant. Even at that, the number of honeycombs experienced at Marble Hill was greater than what would be expected.

The honeycombs, which are surface imperfections, did not pose a problem themselves, but a number of instances of undetected inadequate repair of those honeycombs did point to a breakdown in the implementation of the quality assurance program. Subsequent inspections noted improper controls on the placement of concrete. Additional public attention was given to allegations that the company and its contractor had attempted to "cover up" the improper concrete repairs. A Justice Department investigation, including Federal Grand Jury proceedings, was held but did not result in any findings which indicated criminal actions had taken place.

At about the same time, a question was raised about the company's compliance with the Code of the American Society of Mechanical Engineers (ASME). Portions of the Code have been endorsed by the Nuclear Regulatory Commission and those guidelines set the standards for design, fabrication and construction of nuclear plant piping systems. All discrepancies have since been resolved. ASME has granted the company an "N" certificate, which certifies that Public Service Indiana is qualified to assure that Code requirements are met, and virtually no material was found to be in noncompliance.



When the company announced on August 7, 1979, that it was halting all safety-related construction, it also announced that it would retain a team of independent experts to evaluate the project and to recommend steps which would lead to a resumption of construction. The major conclusion of that diagnostic evaluation was that the company simply lacked sufficient numbers of personnel with commercial nuclear experience. The study noted that while the company had enjoyed considerable success in building coal-fired generating stations, the demands of nuclear construction are much more complex and require greater attention to quality from all levels of company management.

Major steps were taken to correct deficiencies found by the independent study and to meet the specific requirements laid down by the NRC in its confirming order.

One requirement of the confirming order was that verification programs include the examination of existing construction to determine its adequacy and all materials received to determine their suitability for installation in the plant.

For the construction verification program, all accessible and partially embedded reinforcing steel was inspected, an examination of all accessible reinforcing steel was performed, all concrete surfaces were visually inspected, and document and records reviews were performed for all construction areas.

For the materials verification program, a physical inspection was performed on all previously accepted but not installed items. Document verifications were also performed on this material to assure the equipment met proper specifications.

On September 12, 1980, the company made its final report to the NRC based on the finding of the verification programs. In summary, the report said that except for one or two exceptions, the in-place work and materials met proper requirements. A Concrete Evaluation and Repair Program was instituted to repair surface defects found during the verification program.

In addition to tests done on in-place concrete as part of the construction verification program, an independent evaluation was also made of the concrete at the direction of the NRC. After extensive examinations of safety-related concrete structures including pulse-echo tests, line drilling and core boring, the independent engineers concluded that the concrete was acceptable. Despite that finding, an antinuclear group petitioned the NRC for a review of the March 27, 1981, authorization for resumption of safety-related concrete work. The group, Save The Valley, said that the tests did not meet the required degree of statistical confidence specified by the NRC and that the positive finding should be discounted.

A thorough examination of the statistical formula used did locate a problem in a portion of the formula. The faulty portion of the formula was never used, however, since it concerned the large numbers of sample areas that would have been required by the presence of defects in initial tests. If defects had been found in the original 60 sample areas tested, the sampling program would not have provided the required statistical confidence—95% confidence of 95% reliability. No defects were found, however, negating Save The Valley's argu-

ment. In denying the request, the NRC said that the concrete testing program was much more conservative than necessary to attain the 95-95 confidence level. During the test program, 47 of tests were performed in the 60 sample areas that were chosen because their configuration or reinforcing steel congestion made failure more likely. Again, no defects were found.

While work in nonsafety-related areas was not halted during the shutdown period (significant progress was made in the turbine building, switchyard, cooling towers and other areas), considerable effort was directed at a controlled restart of safety-related activities and at building a strong management team.

William M. Petro, executive director - Nuclear Project Management: "We have an outstanding group of people on the job site. Probably as much nuclear talent is concentrated at Marble Hill right now as at any other project in the country."

Also important has been the development of a strong foundation of workable management systems. Two years ago the process of building management systems for scheduling, cost control, inventory budgeting, materials programs, and project controls was begun. Those systems are beginning to prove their worth and will be still more valuable with the more difficult construction work down the road.

One area which must remain a top priority throughout the construction of Marble Hill is quality assurance and quality control. In fact, it is in the area of quality assurance that some of the most dramatic improvements have taken place. The mid-1979 staff of 18 on-site inspectors and some 22 personnel at General Headquarters has been increased to the present level of about 130 full-time quality personnel on site. The quality assurance manual and all the implementing procedures have been completely rewritten.

When questions about the quality of construction are raised, the company and the NRC both have mechanisms for assessing such allegations promptly to determine which ones appear to be substantive and to resolve any questions. Three such allegations have not been substantiated.

The chance of recurrence of serious construction problems has been greatly reduced. Because of the sheer size of the project, there will always be some difficulties but chances for a breakdown of the program are believed very small. The focus on quality by all organizations is expected to identify and correct even relatively minor problems quickly.

The project is currently on schedule for its late 1986 start-up. Milestones necessary to meet a fuel load for one unit in June 1986, and for the second in June 1987, are being verified and these dates are believed realistic. Commercial operation of the units would follow fuel load by about six months.

milestones of progress

Since the shutdown of safety-related activity in August 1979, many significant milestones in the effort to reach full readiness for resuming full-scale construction have been passed. Here is a partial listing:

- A Nuclear Division was created which provided on-site executive-level management representation; those involved with Marble Hill at General Headquarters were relocated to the site to improve logistics; communication and coordination of project activities have been enhanced because all project personnel are on site; accountability and responsibility for all activities are now focused at the site.

- Key Public Service Indiana project management staffing increased from 77 persons in mid-1979 to 231 as of the fourth quarter of 1981. This group represents over 2,400 years of technical experience, an average of over 10 years applicable experience per person, compared to less than four years prior to the shutdown.
- Reorganization and strengthening of the quality assurance function has increased Public Service Indiana staffing to 102 full-time professionals on site. Those personnel represent an average of nearly 10 years experience, compared to slightly over four years per person in mid-1979.
- A gradual resumption of safety-related construction beginning in July of 1980 with receipt inspection.
- Physical construction progress on site, including:
 - Completion of Unit 1 cooling tower and major work on Unit 2 cooling tower.
 - Completion of more than half of the 6000-plus concrete repairs to be made under the Concrete Evaluation and Repair Program (Even though many patches installed prior to shutdown were sound and proper, Public Service Indiana committed to removing and re-repairing all honeycomb repairs to provide an extra measure of assurance that concrete work met requirements).
 - Completion of a 3,750-square foot quality assurance repair storage vault on site that is designed to with stand fires, floods and tornadoes.
 - Installation of the dome cap atop the Unit 1 containment building.
 - Installation of the power crane inside Unit 1 containment.

- Concrete placements—almost 23,000 cubic yards of concrete were placed in safety-related areas following the resumption of that work in April 1981. Some 84,000 cubic yards had been placed in safety-related areas prior to the shutdown. The expected project total in safety-related areas is over 180,000 cubic yards. Some 6,500 cubic yards of concrete were placed in nonsafety-related areas during 1981.
- Completion and energizing of a 345,000-volt switchyard at the site.

A quarter-by-quarter increase in total craft employment on the site during 1980 and 1981 is as follows:

1980

| | |
|-------------|-----|
| 1st quarter | 745 |
| 2nd quarter | 773 |
| 3rd quarter | 843 |
| 4th quarter | 793 |

1981

| | |
|-------------|------|
| 1st quarter | 764 |
| 2nd quarter | 1011 |
| 3rd quarter | 1429 |
| 4th quarter | 1880 |

measurement of progress

As company audits of site contractors indicated the contractors were qualified and ready to resume safety-related construction, and as NRC audits confirmed Public Service Indiana's findings, the NRC authorized step-by-step releases to perform specific work. The first two of the three major construction disciplines (electrical and mechanical) were phased in during December 1980, with authorization to release the civil contractor given in March 1981.

Since the 1979 shutdown, scrutiny of the Marble Hill project by the Nuclear Regulatory Commission has been intense, with the agency devoting a higher-than-normal number of inspector-hours to the project. The NRC frequently inspected to assure compliance with its confirming order, examined the reorganization of project management and quality assurance, tightly controlled the restart of safety-related activities, and since the full resumption of safety-related work, has closely monitored those activities. An inspection report issued by NRC's Region III office in October 1981, indicates how they view Marble Hill at its current status. Quoting from the NRC report:

"Public Service Indiana and their contractors not only have completely rewritten, retrained, and adopted a new philosophy in the quality program areas, but have successfully utilized this program to correct old problems and to control ongoing activities. This program has not been free of problems, but the problems have been properly identified and corrected."

"...quality awareness has become a vital work controlling element. A good example of this is demonstrated in the concrete placed since the resumption of construction in the civil areas. This concrete has been of high quality, free of voids and unsound material, with an excellent surface finish. Any problems that were encountered during this activity were identified in process in accordance with the established program. This enabled the goal of a high quality end-product. Also, orientation and retraining of personnel have re-established a sense of pride and regular use of good workmanship."

"...it is the conclusion of the Region III representatives that the site managers have a thoroughly comprehensive commitment to quality construction and engineering, and it is their clear understanding that senior management fully supports this consideration."

In addition to the NRC inspection, an audit of the project quality assurance program was recently performed by an independent consulting firm. Their report indicated that the program was working very well, and though a few problems remained, they were minor and are being resolved. Overall, the report noted significant improvement from a similar 1980 study.

The company anticipates that the confirming order will be fully lifted in the near future. Even though the order technically remains in place, it is not hindering work schedules. We do feel, however, the formal lifting of the order will represent further confirmation of the improvements made at Marble Hill and of the quality work being accomplished.

summary

Construction and quality assurance problems did occur at Marble Hill. Those problems have been promptly addressed and corrected. The problems occurred sufficiently early in the construction phase to allow us to develop a team and a program which can meet the challenge of the more complex work that lies ahead. In fact, we've already been confronted with and have addressed the kind of problems now being encountered at other more nearly complete projects.

In addition, project personnel are reviewing NRC audit reports from other sites which identify construction or quality assurance problems in order to assure that programmatic changes will be made to avoid similar problems. Our advantage, again, is the outstanding group of professionals we've assembled and the excellent construction program we have in place. Those pluses should help us avoid serious difficulties as construction continues and we move nearer to operation of the Marble Hill nuclear generating station.

Following is a chronological list of events which brought us from the shutdown of safety-related construction to our present status, full safety-related work.

chronology of events

1979

august 7 Public Service Indiana announces halt of all safety-related work; begins search for independent team of experts to do evaluation of project management and make recommendations.

august 15 NRC issues confirming order, formalizing halt of construction and specifies nine points which Public Service Indiana must meet to resume safety-related work.

october 2 Final study report from independent experts issued; recommendations include restructuring Quality Assurance Organization and adding experienced personnel.

december 1 NRC resident inspector begins work at Marble Hill.

1980

january 7 ASME issues "interim letter" of authorization which okays company procedures for meeting the ASME Code.

february 28 Public Service Indiana submits document to NRC in Washington outlining company plans for addressing NRC concerns noted in confirming order.

march 5 Public Service Indiana asks permission to resume receipt inspection, a safety-related non-construction activity.

march 25 NRC holds public meeting in Madison to discuss company request for work resumption; over 600 attend, meeting lasts over seven hours; Save The Valley requests evaluation of Marble Hill concrete by independent inspectors.

may 15 NRC issues guidelines for gradual lifting on confirming order.

july 7 NRC grants permission for resumption of receipt inspection.

september 12 Public Service Indiana reports results of construction and material verification programs to NRC, based on exhaustive examinations (100% examination of surface concrete, thorough examination of structures, review of all previously accepted materials, etc.), except for isolated instances, the work was found to be acceptable; action to correct problems and prevent recurrence outlined.

november 12 ASME audit findings positive, clearing way for resumption of some safety-related work.

december 5 NRC authorizes resumption of safety-related construction in electrical and mechanical disciplines.

1981

january 13 Public Service Indiana receives "N" certificate from ASME.

march 27 NRC authorizes full resumption of safety-related construction.

june 25 Independent concrete consultants make final report to NRC, (interim report was made in March), say in-place concrete is adequate.

october 26 NRC investigation of project management organizations, active areas of construction, notes improvements in construction, project management, quality assurance, management involvement.

1982

january 6 NRC refuses to review decision to allow resumption of safety-related construction; Save The Valley petitioned for review claiming inadequate testing of concrete.